

# **INTERPRETATIONS AND USES OF SEASONAL RAINFALL FORECASTS BY FARMERS IN BURKINA FASO**

by

M. Carla RONCOLI and Keith T. INGRAM (University of Georgia)  
Christine C. JOST and Paul H. KIRSHEN (Tufts University)  
Pascal YAKA and Enok KABORÉ (DMN)  
Léopold SOMÉ and Moussa SANON (INERA)

## **CFAR**

Climate Forecasting and Agricultural Resources Project

A partnership of

Tufts University (USA)  
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Direction de la Météorologie Nationale (Burkina Faso)  
Institut de l'Environnement et des Recherches Agricoles (Burkina Faso)  
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## **1. Introduction**

The Climate Forecasting for Agricultural Resources (CFAR) project is an interdisciplinary research initiative that aims at identifying opportunities and constraints to the application of seasonal rainfall forecasts to improve agricultural production and livelihood security in West Africa. The project is funded by the Office of Global Programs of the U.S. National Oceanic and Atmospheric Administration and implemented by Tufts University and the University of Georgia in collaboration with Burkina Faso national meteorological service (DMN), the national environmental and agricultural research service (INERA), and Plan International, one of the largest international non-governmental development organisations operating in Burkina Faso.

During CFAR phase one (1997-2000), the project team did not disseminate forecasts but conducted field research on:

- a) Local knowledge systems pertaining to rainfall;
- b) Information sources and networks used by farmers; and
- c) Roles of rainfall information in farmers' decisions, including farmers' information priorities and resource constraints they face in responding to climate variability<sup>1</sup>.

In May and July of 2000, however, we did present a three-month rainfall forecast to farmers. Then in January 2001 we interviewed farmers to assess their use of and response to the forecast. In this report we will briefly summarize the results of CFAR Phase one, then present our findings of farmers' interpretations and use of the 2000 seasonal rainfall forecast.

## **2. Summary of CFAR phase one**

Research periods were staggered throughout the year to include wet and dry seasons. Observations also encompassed a range of significant climate events, such as the aftermath of a major drought in the Central Plateau in 1997 and equally devastating heavy rains in the Southwest in 1999. Three sites were selected to represent the main agro-ecological areas and livelihood configurations (see Map). Bouahoun village, near the town of Houndé, is located in a commercial cotton area in the Southwest, with an average annual rainfall of 900-1000 mm. Bonam village, near the town of Boulsa, is in a rainfed cereal farming area in the Central Plateau, with an average annual rainfall of 600-700 mm. In the Sahel, which has an average annual

rainfall of 400-500 mm, two villages, Koria and Sambonaye, near the town of Dori, were selected to represent two extremes of the agro-pastoralism continuum, with agriculture dominating as a source of livelihood in Koria and pastoralism in Sambonaye.

Each of the communities has about 2,000-3,000 residents and is located within 30 km of a provincial administrative center. In the Southwest site, Mossi immigrants increasingly outnumber the indigenous Bwa community. Some *Fulbe* immigrants, who historically tended locally -owned cattle, have also chosen a more settled lifestyle in the area due to increasing restrictions on herd movement and shrinking pasture areas. In the Central Plateau site, *Mossi* farmers coexist with *Fulbe* families that have taken up residence in the uncultivated woodland and scrub areas surrounding villages. In the Burkinabé Sahel, *Fulbe* are historically and demographically the dominant group and identify themselves as pastoralists, while formerly enslaved *Rimaibé* and *Bellah* and the indigenous *Gurmantché* have always been agriculturalists.

In all sites agricultural production depends largely on seasonal rainfall, and is therefore a high-risk endeavor. Producers concur that drawing a livelihood from the natural environment, whether by farming or by herding, has become increasingly arduous and risky during the last two to three decades. Farmers reported a greater frequency of water-deficit years, late onset of the rainy season, premature end of rains, and anomalous rainfall distribution. Crop production strategies strive to manage risks and reduce losses by diversifying field locations, types of cultivated soils, and crop and variety mixes. In all sites farmers expand cultivation in lowland or upland fields according to their expectations of seasonal rainfall, but land shortage limits this strategy, especially in the Southwest site.

Crop production systems center around cultivation of grain sorghum (*Sorghum bicolor*) and millet (*Pennisetum glaucum*) and other crops, such as peanut (*Arachis hypogea*), bambara nuts (*Vigna subterrenea*), cowpea (*Vigna unguiculata*), and sesame (*Sesamum indicum*). Most production is for household consumption, with some surpluses being sold on local markets. Among staple grains, sorghum prevails in the Central Plateau site, complemented by smaller acreages of millet, maize (*Zea mays*), rice (*Oryza sativa*), and other crops. There are several local sorghum varieties. Farmers have responded to increased occurrence of drought and shortening of

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<sup>1</sup> We use the term ‘farmer’ in a broad sense, including crop producing agriculturalists and livestock producing pastoralists, men, women, and children, whoever participates in farm operations or makes resource management decisions.

the rainy season by shifting from traditional varieties that had a longer duration (120- to 150-day) to those that have medium duration (70- to 90-day) or short duration (50- to 60-day).

Millet is the staple of choice in the Sahel and is grown mostly in sandy soils. Seventy- to ninety-day sorghum varieties, which ripen before local millet varieties, are being planted more often, especially in valley bottoms and in rainy years on clayey soils that were previously used for pasture. Expansion of agriculture and declining rainfall make it more difficult for *Fulbe* households to make a living on livestock production alone, so many households combine transhumant pastoralism with some crop production during the rainy season. At the same time, agriculturalists are diversifying into livestock production. In the Southwest, cotton farming has reduced the diversity of cropping systems, although profits are too small for farmers to abandon household food production. Most farmers grow similar acreages of cotton and maize, with small fields of rice, sorghum, peanut, sesame, and beans. Varieties of food crops are often poor quality derivatives of 'improved' varieties, which the extension service makes available for purchase on an erratic basis.

SOFITEX is a semi-private partnership of the Burkina Faso government and the French textile industry that purchases, processes, and exports cotton. By channeling technology, inputs, and credit, SOFITEX has enabled Southwest farmers to have far greater market orientation and access. A few wealthy farmers in the Southwest have tractors and most farming households own at least one plow and pair of oxen. In contrast, less than one-fourth of households in the Central Plateau site own plows, while Sahelian agriculturalists do not use plows because the topsoil layer is too shallow and sandy and the subsoil too rocky.

In the Central Plateau and in the Sahel sites, farmers apply manure and organic matter to selected fields, whereas Southwest farmers use large quantities of chemical fertilizers, herbicides, and insecticides in addition to manure. Inputs are bought on credit from SOFITEX through cotton producers groups, and the costs are subtracted from cotton sales revenues after harvest. The amount of money farmers owe to the company is a major factor in farming decisions: farmers need to plant cotton to obtain cash for their inputs, which they use for both cotton and maize, even in climatic and agronomic conditions that might be better suited for other crops.

In all three regions, livestock husbandry systems center on the herding of ruminants. Although historically the *Fulbe* specialized in the husbandry of cattle, most family livestock

holdings now include cattle, sheep, and goats. In the Sahel some farmers also keep camels and they produce small ruminants for either consumption or sale. They usually keep cattle for milk production, although they may also sell cattle in response to climate or economic stress. In the Central Plateau and the Southwest, some Mossi have adopted herding lifestyles.

Although most Sahelians still carry out some form of migration with their animals, many farmers in the Central Plateau and most in the Southwest now graze their animals in the vicinity of the village all year round. In the Sahel, pastoralists base decisions about migration direction on information they receive concerning pasture availability, often from immediate family members who have been sent as scouts. Although pastoralists favor traditional migratory routes, with increasing frequencies issues such as agricultural encroachment have resulted in most decisions concerning migration direction being made on a seasonal basis, using the latest information available. Pastoralists decide when to leave for migrations based on how much pasture is available near village and the manure needs of the family's crop fields. In the Southwest and Central Plateau, if pasture remains available year round, pastoralists will usually not migrate, which is also becoming more common in the Sahel.

All households in the Southwest site own at least one radio and several households own battery-operated televisions. About one-third of households in the Central Plateau site and one-fourth or fewer in the Sahel own radios. Very few households have televisions in these sites. The Southwest site receives Radio Nationale du Burkina (RNB), which is relayed from Bobo-Dioulasso where several private FM stations also operate. The Central Plateau site receives RNB from Ouagadougou, although the transmission is occasionally disturbed. There are a few private FM stations in the area but they have limited span. The Sahel sites lay outside of the RNB broadcast range, but there is a foreign-sponsored community FM station in Dori that reaches 100 km or more away from Dori and is widely listened to. Better quality radios can also tune into Mali and Niger radio stations and farmers reported listening to weather reports from these countries.

### **3. Development and dissemination of the 2000 forecast**

#### **3.a Building a consensus forecast**

In 2000, CFAR organized the experimental dissemination of forecasts to farmers in its three sites. A provisional forecast was presented at the Climate Outlook Forum, also known as

PRESAO (Prévisions Saisonnières pour l'Afrique de l'Ouest), a yearly conference since 1998. The forum in 2000 brought together forecast producers and potential users from most West African countries in early May, that is, before the onset of the rainy season. The purpose of the Climate Outlook Forum is to discuss the scientific aspects of forecasts, to receive feedback from users, and to develop a consensus forecast for the region. The consensus forecast is produced by combining forecasts developed by each national meteorological service on the basis of sea surface temperatures (SST) and other models of international meteorological centers like the Hadley Center and the U.S. National Oceanic and Atmospheric Administration (NOAA).

The 2000 Climate Outlook Forum was held in Ouagadougou on May 8<sup>th</sup>–12<sup>th</sup>, 2000. The core of the program was a workshop, during which climate scientists interacted with a small group of farmers from the CFAR sites and elicited their information needs and their views regarding the potential uses of forecasts (Roncoli et al., 2000). Farmer participants were selected jointly with relevant community leaders and committees, but all of them were key project informants with whom the project had worked since the beginning of the project. They included individuals of different ethnicities and wealth levels, and a few women.

In West Africa, seasonal forecasts predict total rainfall during July, August, and September, the three-month period at the core of the rainy season during which 80% of annual rains fall. Forecasts are presented as the probability of the rainfall being in the high, middle, or low tercile of long-term historical rainfall data series. Therefore it is a relative measure of total quantity of rainfall rather than of distribution during those three months.

The forecast developed at the forum for Burkina Faso indicated a 40% probability that seasonal rainfall would be in the higher tercile, 40% for the middle, and 20% for the lower tercile. At a meeting preceding the Forum this distribution was presented to the participating farmers by laying out differently colored slips of paper (40 green, 40 yellow, and 20 red), and then placing them in a bowl and randomly selecting one slip of paper. The selection was repeated several times to show that the low probability scenario can occur, though with lesser frequency. The presentation of tercile forecasts for the three climatic zones of Burkina Faso was repeated during the scientist-farmer workshop during PRESAO. The presentation was in local languages and facilitated by CFAR's site facilitators, who are extension and development workers who have known and worked with the farmers of each site for many years.

Yet, a consensus forecast does not ensure consistency of interpretations. Differences in concerns of key stakeholders shaped how the forecast was presented. On the last day of the Forum the Director of the DMN held a press conference, announcing a “good probability of at least average rainfall.” He did not announce the quantitative probabilities, instead giving a more cautious general interpretation, aware that adverse consequences could ensue if the forecast was perceived to be wrong. The press conference was in French, but was also reported in local languages by the Rural Radio branch of RNB.

During its weekly radio program SOFITEX publicized “a strong probability of abundant rainfall” and encouraged farmers to continue planting cotton well into the season. The radio program does not have a large audience because it is broadcast in the morning when farmers are in their fields, but local FM stations, which SOFITEX occasionally engages to transmit news on its behalf, relayed the information.

### 3.b Bringing the forecast to the communities

The seasonal rainfall forecast was updated at the end of June, with minor changes (35% higher, 45% middle, 20% lower tercile). In mid-July a team composed of collaborators from the DMN and INERA traveled to the CFAR sites to present the updated forecast to the communities. The presentation was done during a village meeting, which had been convoked by the CFAR facilitators during previous visits and (in the Sahel site) by broadcasting the information over the local radio. The meeting also included those farmers from the community who had attended the Climate Outlook Forum<sup>2</sup>.

The information presented at the village meeting reiterated what had been presented to farmers during the pre-Forum and Forum meetings. The DMN/INERA team informed the communities that their studies predicted that:

- a) Seasonal rainfall in 2000 would be in the ‘middle range’ (*moyenne*)<sup>3</sup> : in particular, they expected rainfall to be less than that of 1999 but more than that of 1997;

Keith T. Ingram

**Comment:** Again, I understood that DMN and INERA presented the forecasts developed by DMN, and that these forecasts had slight differences among the three zones.

<sup>2</sup> Under normal circumstances, farmers in the Central Plateau and in the Southwest sites would have already planted most of their fields, but because the onset of the rainy season was late in both areas farmers still had the opportunity to use the forecast information in making planting choices.

<sup>3</sup> The team used the French term ‘medium’ to convey ‘average’ or ‘normal,’ which cannot be easily translated in local languages.

- b) Seasonal rainfall in 2000 was expected to resemble that of 1991 for the Sahel, 1971 for the Plateau, and 1995 for the Southwest. These years with expected similar conditions during the rainy season are called analog years.

The team also explained that:

- a) The forecast is ‘probabilistic,’ meaning that there is a margin of uncertainty;
- b) Forecasts are for ‘zones’ and do not predict rainfall in a specific village or a field;
- c) Forecasts relate only to July, August, and September rainfall;
- d) The forecast cannot predict onset or end of the rainy season

Based on past data average dates for onset and end of the rainy season are:

	<i>Onset</i> <sup>4</sup>	<i>End</i> <sup>5</sup>
Dori	8-20 Jun	16-26 Sep
Boulssa	25 May – 8 Jun	6-16 Nov
Houndé	25 Apr – 3 May	26 Oct – 5 Nov

Between mid-January and the end of February 2001, the CFAR team returned to the research sites to assess the impact of forecast dissemination. The team included an anthropologist, an agronomist, a water resources specialist, and a veterinary doctor. The CFAR site facilitators assisted the CFAR researchers. DMN and INERA collaborators also joined the CFAR researchers during this time for a restitution meeting with the communities during which they presented data about the actual outcome of 2000 rainy season in the zone in question, in different areas of Burkina Faso, and in neighboring countries, and clarified misunderstandings relative to the forecast disseminated in July.

The CFAR assessment team spent from one to two weeks in each site doing semi-structured interviews and focus groups to understand what rural producers had understood, how they had used the information in their production choices, and how it could be better explained and delivered to farmers. Interviews were also carried out in one different village in each site, which was selected on the basis of relative similarity to the CFAR villages, to assess the extent to

<sup>4</sup> The DMN marks the onset of the rainy season on first day after 1 May when it begins raining and at least 20 mm fall during 3 consecutive days that are not followed by a period over a week without rain. However, for the South, where rains may begin before 1 May, the definition used is a technical calculation based on shearing of winds at altitude formulated by Prof. Otmotosho for Nigeria.

<sup>5</sup> The DMN defines the end of the rainy season in terms of cumulative rainfall, namely the day after 1 September after which there is less than 2mm rain during a period of 20 days.



which information had circulated to areas the DMN/INERA team had not reached. These ‘control’ villages were Dani in the Sahel, Bouala in the Central Plateau, and Bombi in the Southwest.

From 5 to 15 group and individual interview sessions were conducted in each village, including samples of villagers who had and had not attended the meeting with the DMN/INERA team in July (see Table 1). The sampling strategy had to adapt to the mobility of rural life and accepted patterns of public interaction in the Sudan-Sahel. In other words, we questioned agriculturalists and pastoralists we could find. In the Sahel, often groups of several men and women gathered at the interview sites, although generally one or two people responded to most of the questions. Overall, far fewer women than men attended the village meeting and were interviewed during the fieldwork. Because men generally make the major production decisions for their household, interviews targeted male respondents who had received the forecast.

For the sake of consistency, our analysis is based on number of interviews, regardless of the number of people attending. While the small size, non-random, and heterogeneous nature of the samples limits the analyses that can be done with the data, it made it possible to obtain in-depth ethnographic information from farmers, some of who have known and worked with the team for several years. Since we want to understand farmers' perceptions, we asked questions in a way that allowed them to identify the issues that were most important to them. Thus, the fact that a certain number of farmers reported on any observation does not mean that other farmers interviewed did or did not make the same observation. Rather those that did not report a specific phenomenon may have observed or be more concerned with something else.

Keith T. Ingram

**Comment:** It would be good to include a table with numbers men, women, and total for each interview and location.